The Scientific Review,

AND

SCIENTIFIC AND LITERARY REVIEW,

A RECORD OF PROGRESS IN ARTS, INDUSTRY, AND MANUFACTURES,

INCORPORATING THE

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SUBJECT MATTER INDEX OF APPLICATIONS FOR PATENTS.

September 20th to October 20th inclusive.

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⁂ *The above List is prepared from the Patent Records by Mr. T. Morgan, Secretary of the Inventors' Patentright Association, Limited.*

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THE ELECTRIC LIGHT.

"The Electric Light for Industrial Uses." By R. E. CROMPTON, Electric Light Engineer and Contractor. London: Mansion House Buildings, E.C., and Anchor Ironworks, Chelmsford.

MR. Crompton, in his introductory remarks, says that the electric light has passed out of the hands of the experimentalist into those of the mechanical engineer. Every day new installations of the light are announced and something is added to our stock of practical knowledge of the subject. After criticising the various books on electric lighting that have been published, he states that having been for some years engaged as a manufacturer of apparatus connected with the electric light, and more lately as a contractor for the temporary supply of electric lights for various purposes, he has felt the want of a practical handbook to be a great one.

"This want I now endeavour to supply. My desire to compress into my limited space as much as possible of what I believe to be the most recent and trustworthy information regarding the light must be my excuse for many shortcomings and omissions. I have endeavoured to be strictly impartial in my judgment of the merits of the various steam engines, dynamo-electric machines, conducting cables, carbons, and other accessories to the light. About the lamps I cannot speak so impartially. My whole aim for the last two years having been to combine in my own lamp all the merits, and exclude from it all the defects of my predecessors and rivals, must render my judgment favourable to my own to the exclusion of others."

Limited space throughout, Mr Crompton states, forbids him to give his authorities, but readers of Du Moncel, Desprez, Fontaine, Breguet, Mascart, Siemens, Schwendler, Preece, and Hopkinson, will recognise how much is due to the labours of those writers.

The work, which is one of only 41 pages, contains much practical information on the electric light. In proof of this we present our readers with the following quotation:—

"The contention is that Siemens' and Serrins' lamps fail in delicacy of feed mechanism; in other words, instead of advancing the carbons as they are consumed in a regular continuous feed, they advance it at considerable intervals of time, in quanities of one-eighth to one-sixteenth of an inch, accordingly as the lamp is clean and consequently sensitive, or dirty and consequently sluggish. The result of this intermittent feed is that the arc varies greatly in length; if the current is inclined to be unstable, as may be the case with low tension machines, the fluctuations in the strength of the current on which the lamp depends for starting the feed, are so sudden and violent that the current falls almost instantaneously so far below the point at which an arc can be maintained, and that the arc ceases and all current in the machine also ceases, until the carbons come together again and the arc is re-established.

"In early days of the electric light, these temporary extinctions, longer or shorter in duration, according as the lamp was regulated for a long or short arc, were quite expected and were not much grumbled at; but now the case is different, such lamps would not be tolerated for a moment. Although the extinctions do not now occur with a well regulated Serrin lamp, the feed is still sufficiently irregular to cause the carbon points to constantly alter their form; each time a feed is made the light becomes pure white from the shortness of the arc, often hissing then takes place, as the arc burns longer, the arc gets quieter, and after passing the point at which it should be maintained, which we may call the normal arc, it gets far too long, the colour of the light changes from white to purple and blueish white, and the arc plays irregularly about the coned part of the two carbons, sometimes circling entirely round them, and giving a very irregular illumination of the floor space.

"The blame of these defects has been too often visited upon the unoffending engine which drives the machines, or upon the manufacturers of the carbons. In truth, neither are to blame. It is the feed mechanism of the lamp that is at fault. If its feed mechanism were sufficiently prompt in responding to the small changes in the strength of the current, or to the slight differences of potential on the two sides of the arc, the feed motion could be made practically continuous, and an extremely steady and uniform light could be obtained with an indifferent engine and ordinary carbons.

If we consider that the feed mechanisms of electric lamps are in a sense analogous to the governors of steam engines, if we substitute the varying intensity of the magnetic field in the electro-magnets or solenoids of the lamps for the varying centrifugal force of the steam engine governor balls; again, if we substitute the mechanism which controls the advance of the carbons for that which controls the throttle-valve or cut-off gear of the steam engine, the parallel is complete. The efficiency of a steam engine governor depends on its promptness in responding to the slight variations of centrifugal force of revolving masses of metal, the promptness is insured by reducing the mass of the parts actuated as far as possible; in other words, by giving the centrifugal force but trifling weights to start from one position of stability, and the same trifling weights to arrest in the new position of stability. Any increase in the weight of the parts, however well and carefully counterbalanced, causes sluggishness in starting, and liability to overshoot the new position of stability before the motion of the parts is arrested. This causes a swinging, or, as it is called by engine men, a "hunting" action of the governor. Carrying out this parallel further it will be seen that all electric lamps *hunt* more or less. They do not commence to feed until the current is too much reduced, and do not arrest the feed until the current is too much increased by the carbons being approached too closely. In the Crompton lamp the same remedy is applied as has been before successful in engine governors. The weight and size of the moving parts of the break mechanism which controls the advance of one or both of the carbons has been reduced to a minimum; in some of these lamps the moving arcs only weigh a few grains. Thus the varying strength of the magnetic field of the lamp magnets has an extremely small amount of work to do.

"A general idea of the arrangement of lamps, as far as it can be obtained without reference to diagrams, is this:—The upper part which contains the mechanism consists of a pair of top and bottom plates united by a pair of flat frame plates, which form the sides carrying the train of wheelwork. This part is covered in by a glass cylinder held at top and bottom by grooves in the plates. The movement can thus be watched without removing any cover. When the lamp is intended to burn more than five hours it is extended below the bottom plate in the form of a large tube, which carries at its lower end the guides to steady the long carbons required; these carbons are steadied through a platinum contact at the bottom of the large tube. Thus the length of carbon between contacts remains constant during the time the lamp is burning, and the carbon resistance therefore remains constant also. This is a point of considerable importance, as the resistance of 24 inches, or sufficient length for eight hours burning of carbon, is about ·3 ohm., and the reduction of this amount of resistance at the time when the lamp is fresh lighted to practically nil when the carbons are burnt out would seriously alter the current when this is of low tension, When lamps are to burn less than five hours. this carbon resistance being not so important and the carbons being stiff enough to support themselves in line without the aid of guides, this lower part is dispensed with."

Although Mr. Crompton cannot, as anyone will see, refrain from praising his own invention, yet we can assure our readers that his little work contains much practical information on the subject at large.

COLONIAL EMIGRATION.

"Extended Colonisation a Necessity to the Mother Country." A Paper read at the opening meeting of session 1879-80 of the Royal Colonial Institute. By STEPHEN BOURNE, F.S.S. London: Unwin Brothers, 109A, Cannon-street, E.C.

MR. Bourne argues very lucidly and impressively that emigration is one of the most available means for promoting the welfare of this country and its inhabitants, and thus sums up the matter:—

In the Colonies there is abundance of unoccupied land, every variety of climate, every description of food and of material for clothing. Pioneers have gone forward to prepare the paths for those who are to come after them, so that there are few places in which friends and companions are not to be found; whilst postal and telegraph communications keep up constant and close intercourse with those who may be separated by wide continents or broad seas. In many of our possessions, and in other uncivilised parts which are ready for forming attachments with us, there are large bodies who would soon become our customers for merchandise and our growers of food with whom a profitable trade will in time be developed, if only we send as settlers amongst them those who are prepared to cultivate amicable relations rather than to extort from them the goods or the labour they have to give; to carry the gifts of civilisation rather than those of the sword.

In former times two classes were disposed to emigrate—those whose spirit of enterprise and desire for wealth led them to brave hardships, in the hope of returning home to spend their later days in ease and plenty; and those who, having misconducted themselves or otherwise broken down at home, found it desirable to seek new places to live. Hence Colonial life was rude and rough. Few cared to become steady settlers, or to cultivate the comforts and happiness of home. These may still go in considerable numbers, but we also want those who, with settled intention and hearty desire, change their country, but carry with them or speedily make permanent homes wherever they go. The increasing numbers and the rapidity with which these are added to in newer countries, forbid the expectation of return. The many must, once for all, transfer themselves to the fresh locality, seeking to make it as much like the old one in everything that is good, and as much unlike it in everything that is ill, as they possibly can. The feeling must not be that of expatriation, but that of extending the borders of the fatherland.

This, too, should be the spirit to actuate the Home Government in all its relations with existing or yet to be formed Colonial possessions. All distinctions of laws and customs should be swept away, and the same principles and methods of rule should be adopted, or only withheld for a time in the case of untutored natives. Whatever institutions, religious, educational, scientific, or philanthropic, have been found to work well at home, should be founded, improved, and adapted to the special requirements of each place. Whether it would be possible to form an entire federal union of all parts of the British Empire, so as to have the same fiscal laws and regulations, is too wide a subject to be entered upon on this occasion; but there can be no question that if practicable it should be adopted, and if not altogether feasible, that no unnecessary obstacles should be placed in its way, or any departure from its spirit encouraged. If it be necessary for revenue purposes, on account of the different positions in which they are placed, to have different rates of duties on the importation of goods, they should undoubtedly differ as little as possible, and every attempt to establish Protection on either side as against the other be utterly repudiated.

It is the duty of the mother country to set the example and exercise her authority for the general welfare, but it is also the duty of the children to follow and acquiesce in that which is for the benefit of both. The idea of separate interests or independence of each other is utterly inadmissible. The object on all sides should be to draw tighter the bonds of union, to weld every portion of our dominions together into one harmonious whole, to make everyone with in the bounds of the British empire feel and act as an inhabitant of the one kingdom.

I have spoken of the necessity imposed upon the mother country that she should extend and perfect the colonisation of her numerous possessions, but is it not equally a necessity to those possessions that they should be fully colonised? She has more than an abundance; they, with few exceptions, a paucity of population. She is unable to raise her own food, they can raise more than they can consume. She has a plethora of wealth which seeks employment in foreign lands; they have need of more than she can give to develope their untold resources. She has the knowledge, the refinement, the treasures of art and science, accumulated in the course of the years that are past; they have yet to obtain these invaluable possessions in the years that are to come. The necessity is mutual; let both be gainers by its being met and supplied. These are considerations which can no longer be neglected or evaded. They force themselves upon us in our homes and our offices, in the palace and the hovel; they should tax our intellects and lie near our hearts. When these sentiments prevail, and—presumptuous though it may be in me to say so—not till then, will there be any solid return of national prosperity. Whensoever they are held by the leaders of public opinion, and responded to alike by the voice of those at home and those in our colonies, the work will be viewed as the most important that can occupy public attention, and all together will join in its performance. Then the most important and influential member of the Government will not be the Minister who sits at the Home Office, not the one who presides over War, not even he who rules at the Exchequer, but the honoured individual into whose hands Her most Gracious Majesty commits the affairs of the Colonial Office.

THE WATER SUPPLY.

"Domestic Plumbing and Water Service." By WILLIAM WHITE, Fellow of the Society of Antiquaries and Fellow of the Royal Institute of British Architects. London: Crosby Lockwood and Co., 7, Stationers'-hall Court, Ludgate Hill. 1880.

MR. White, who is eminent not simply as an architect, but as a sanitary improver, states that in commending the pages of his work to the favourable notice of his brother architects, his medical and other scientific friends, and the public generally, he may obviously and reasonably be presumed to write with a certain amount of bias, from having a personal interest, as an inventor, in several patented sanitary appliances. The appliances specially referred to being those made by Messrs. Frank Pierce and Co., Shrewsbury Sanitary Works, 1 and 2, Little York Place, Baker-street Station; viz. the Shrewsbury Valveless Closet (with valveless Water-Waste Preventer and Regulator); the Shrewsbury Wasteless Lavatory; the Shrewsbury Automatic Ball-valve, and other waterway taps; and certain Domestic Fittings.

Nevertheless, Mr. White wishes to express his conscientious conviction that the fullest inquiry into the questions discussed, and the fullest information afforded to the general public as to practical details in such matters, will be for the common benefit of all.

He ventures further to indulge a well-grounded hope that the principles upon which these practical details are here treated will meet with careful and impartial consideration.

The work refers to the water service, the water closet, the water valve, the drain ventilator, and remedies for existing evils. Probably the most important question treated of in this little work is :—

THE WATER VALVE.

The occasional accidental running away of water from the household cistern, to those especially whose supply is limited, has been for many years a constant source of vexation, inconvenience, and expense. At times I have lost my daily store of water, day after day, before discovering the cause, which has eventually proved to be due to the valve of one or other of the several w.c.'s getting occasionally (but not continuously) propped by the handle; or by the valve being improperly fitted, or some similar cause.

For purposes requiring an excellent flush, with a strictly limited quantity of water, it is proposed to do away with this valve altogether, substituting for it something which is capable neither of leakage, nor yet of wilful or careless waste of water from being purposely propped or accidentally left open.

The valve at present ordinarily used to serve the basin of the w.c. being one of the most fruitful sources of waste, its total abolition will prove one of the greatest boons in respect of domestic water supply yet brought before the public. The cost of good valves at first, and in successive adjustment and repair; their inevitable liability to leakage, and other derangements; the difficulty of getting fullway valves of large capacity and keeping them in working order when obtained; their frequent damage from frost, obstruction, wear, or neglect, must render a satisfactory substitute for them a matter for general rejoicing.

The new apparatus, of course, like all other water apparatus, may be disabled, though it is not liable to be deranged, by frost. But pipes, closets, and valves ought always to be securely protected against the effects of frost, and in ordinary circumstances and positions this may easily be done by casing and other means. Even a common brass French oil hand-lamp will keep out frost from a good-sized cistern, when protected from draughts of freezing air.

A ball or floating valve-tap to feed the waste-preventer cistern, whether by constant or intermittent service, will still be required. In the working of these ball-valves, however, great and manifest improvements have now been made, by a further invention which will reduce to a minimum the chances of leakage and waste. This is effected by the adoption of an entirely new principle in their construction, the very opposite to that hitherto generally used; which principle ensures its immediate and automatic action in closing. The only force required to open the valve is applied below, or externally to the waterway. Under high pressure this force is very considerable, and is met by a simple method of single or compound lever as the case may be, its action being by way of direct counterpoise to the column of water within. It is without stuffing or packing of any sort, and quite free from all liability to stiffness or sticking.

It is evident that in the adoption of such a ball-tap, combined with a valveless and waste-preventing regulator, incapable in its operation of leaking or of being left running, the most complete provision that can be devised against waste is obtained.

BRITISH WILD FLOWER.

"British Wild Flower, by Natural Analysis." By FREDERICK A. MESSER. London: Bogue.

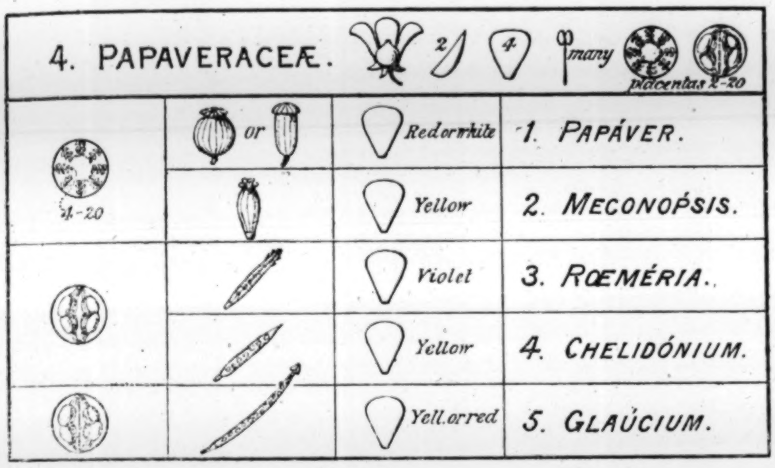
[SECOND NOTICE.]

THE principle of analytical arrangement, so useful in bringing before the student in a concise manner the relationship which plants bear to each other, has hitherto been confined to verbal description. In Mr. Messer's work is presented the novel feature of the application of this principle to the illustrations, as well as to the verbal description; the illustrations being placed on one page and the letterpress on the page opposite. Thus the information is expressed in two distinct ways.

There can be no doubt that this system of dealing with illustrations will greatly facilitate the acquisition of a clear and comprehensive knowledge of our native plants, and will be found especially useful as a rapid means for their identification. Instead of struggling through a stockage of technical terms the beginner can, by this new method, readily perceive the relationship which the parts bear to each other, and at a glance discriminate with certainty which of the figures agree with his specimen and *which of them do not.* The mind will be freed from that feeling of doubt as to whether after all the right selection has been made, which is unavoidable when studying by the aid of letterpress alone. Thus the student's progress will not only be rapid, but at the same time sure. Should this work lead to the orders and genera receiving greater attention it will do good service. One of the principal difficulties experienced by the field botanist is created by his neglecting the study of the ordinal and generic features and devoting himself too exclusively to species as individuals. This devotion renders his experience of little benefit in future investigations; whereas had he more fully studied the orders and genera he would have been enabled to recognised at once a plant's affinities.

The illustration we give (see next page) of Mr. Messer's work will convey a good idea of the system upon which it is based. We may mention that want of space has compelled us to contract the letterpress part.

"TEARS AND RAINBOWS."—It has frequently been observed that a desired impression can sometimes be produced by poetry when all else fails, and hence it is that it has been successfully employed for imparting religious instruction as well as for the exciting of the most dangerous human passions, but in poetry of a religious character the author is apt to overstep his bounds, and exaggerate to an extent which renders his labour fruitless; it is, therefore, quite refreshing to turn to such a volume as "Tears and Rainbows, or Heavenly Sunbeams on Earthly Sorrows," by the Rev. Professor George Butler Bradshaw (London: A. Bachhoffner, High-street, Clapham), which, although purely religious in tone in every line, is altogether free from the overstrained style too often adopted. Throughout the whole of the 35 poems contained in the volume, there is the ease and smoothness which indicate the possession of that poetical faculty which no amount of teaching can impart, whilst the subjects selected will suit the tastes of every cultivated reader. The author displays in every line his love of Nature and his confidence in his Creator, feelings which will not fail to be generally appreciated. More scholarly and accurate poetry could not be desired, yet it has a softness and gentleness which will make it attractive to the least as well as to the most highly cultivated, whilst the fact that it will prove equally acceptable and agreeable whatever may be the reader's sect or creed, justifies the prediction that the second edition which has now been reached will not be the last. Apart from the pleasure which the volume will afford, it may safely be said that no one will read it without deriving instruction and advantage, and would appear to be very suitable either for a prize book or Christmas present.



4. POPPY FAMILY. Corolla regular, polypetalous, inferior. Sepals 2. Petals 4. Stamens many. Capsule 1 or 2-celled; placentas 2 to 20, many-seeded.

Capsule 1-celled; placentas 4 to 20 (forming imperfect cells).	
Capsule globular or oblong. Petals red or white	1. Poppy.
Capsule obovate. Petals yellow ..	2. Welsh Poppy.
Capsule 1-celled; placentas 2.	
Capsule linear, bristle-pointed. Petals violet	3. Rœmeria.
Capsule linear, smooth-pointed. Petals yellow	4. Celandine.
Capsule 2 celled; placentas 2.	
Capsule very long, curved. Petals yellow or red	5. Horned Poppy.

SHREWSBURY PATENT CLOSET.

This closet (which is alluded to in the review of Mr. White's pamphlet on Domestic Plumbing and Water Service) is placed behind a casing at the back or side of the closet. The contrivance consists in drawing, from the top of a small cistern *c* (Fig. 6) holding a regulated supply, enough water to form an efficient flush, through a properly formed hopper basin. This is effected merely by means of a movable flap or tray, *t*, within the cistern, by the raising of which the requisite quantity is lifted out, whether bodily or by pressure against the sides, into a funnel, *f*, and so discharged by a pipe *p* into the basin beneath, through which it rushes, clearing out the contents. It will be seen that this small cistern, having no opening except at the top, and being without any valve or other outlet for the water below, cannot be liable to leakage or other derangement. The hopper or flushing basin (Fig. 7) is of such form as to hold as much water (w) as an ordinary pan or valve closet, and thus is capable of being kept equally clean; whilst it is at the same time capable of being thoroughly flushed. It has provision for a circulating system of ventilation in the trap which cuts off the soil pipe. The basin being of good form, and of Wedgwood, or other good ware, its use for the better class of houses will not be open to the objections which have hitherto entirely prevented the adoption of all descriptions of hopper or flushing basins for anything but the cheapest and commonest purposes. The whole apparatus is complete in itself, the basin requiring only to be placed upon a wood block or a frame on the floor of the closet; and, being fixed eight inches *above* the floor, it is easily made good into the soil pipe. The cistern is fixed on a bracket or shelf above, the only other requisite being a half-inch or three-quarter inch supply of water, laid on ready for the attachment of a ball-valve at *b* (Fig. 6) to the apparatus cistern; and some pipe for ventilation below the basin at *x* (Fig. 7) to prevent syphoning, and to create a current of air in the pipe. The apparatus cistern, described above, forms an effectual regulator and water-waste-preventer, in one; holding as it does the required quantity of water for each discharge. Seeing that the volume of water thus lifted out at one moment is from one to two gallons, the service pipe may be of any reasonable capacity, and a flush of two inches or more readily obtained. The quantity may be accurately regulated by the adjustment of the ball-valve.

A further advantage of this arrangement is that by means of it the separate cistern (now required by all Sanitary Authorities) is of necessity already provided, without the cost or inconvenience of any other intermediate cistern for the purpose of separating the closet service from that of the house. The supply cistern of the house can thus be placed at such a distance from the the closet, or other tainted position, as to secure it from contamination.

This waste-preventing regulator might be made applicable, if desirable, to existing pan or valve closets of the common sort. But it would not be desirable. Those who care only for the prevention of waste might rest content with this. But those who would escape the evils of such pans or valves must have recourse to the special application of the regulator provided by means of the new flushing pan. The same may be said of the common hoppers or old flushing pans. It might be made applicable to these; but according to their present usual construction, and for the reasons before given, only the benefit of waste-preventing would be obtained. Their nozzle (*n*, Figs. 3 and 4) for the inlet service pipe would be far too small to allow of a sufficient quantity of water being admitted for proper flushing: in fact, in order to keep such basins clear it is the common practice to throw down a pail of water occasionally. Cheap and common sorts of the Shrewsbury closet will necessarily be required in many cases, for cottages, and for servants' offices. In order to meet these requirements, arrangements have been made for their supply, of the proper form under the patent, for adaptation to the new waste-preventing flusher.

In the hopper or flushing basin, to be used with the water-waste-preventing flusher just described, there is a provision for rinsing the sides. The two-inch pipe *p* is brought down, through a notch or indention (Fig. 7) over the edge of the basin without interception or interruption by any joint or other inequality, and the full force of the water is thus still given to the operation of flushing.

It may, perhaps, be desirable to remind our readers that Mr. White, F.S.A., of Wimpole-street, is the originator and patentee of the above-described invention.

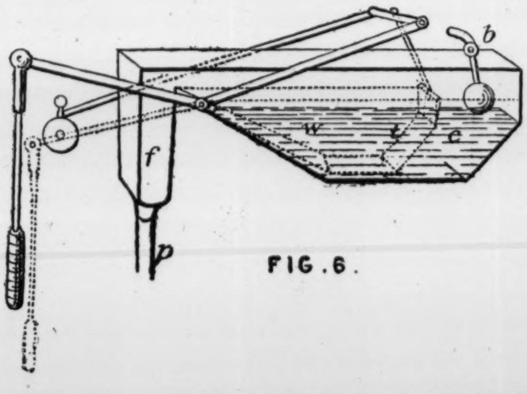


FIG. 6.

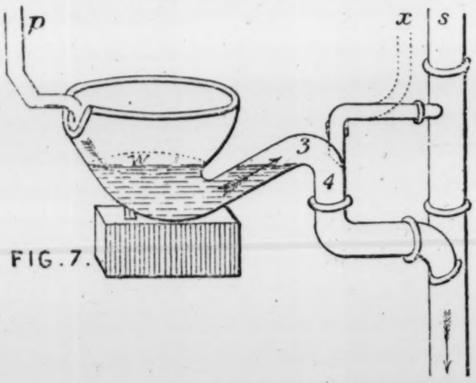


FIG. 7.

A NEW method of preserving raw meat for six months has been discovered by Prof. Artimini.

An improved *thread case*, which exhibits the thread to the greatest advantage, and permits of getting any desired kind of thread instantly and easily, has been patented by Mr. Eugene L. Fritch, of Bieda, Iowa. The invention consists in a case with a glass front and top, and with a floor inclined from front to rear, and provided with a series of drawers, each containing a number of spools of thread which are held by spring catches at the end of the drawer, so that if a button on the drawer is pulled a corresponding spool will drop from the drawer and roll down the inclined floor toward the salesman.

The Scientific Review

AND

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THE SESSION 1880—1881

Is to commence with the Opening Meeting on Thursday, 25th November, at 4.30 p.m.

Members' Meetings at 8 p.m. on Thursdays, November 25th; December 9th and 30th; January 13th and 27th; February 10th and 24th; March 10th and 24th; April 7th and 28th; May 12th and 26th; and June 9th.

Annual General Meeting, Thursday, May 26th, at 4 p.m., unless otherwise arranged.

Subscriptions are payable to Mr. G. A. Stretton, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. Campin, Sec.

Proceedings of the Institute.

The Institute having been out of Session, no meeting has been held which requires a report.

On Thursday, November 25th, it is proposed to have the Inventor's Dinner, and the Opening Address will be delivered.

Monthly Notices.

Electric lamps, fourteen in number, light the railway up Mount Vesuvius. The illumination of the crater and the sides of the volcano is, according to the *Elektrotechnische Zeitung,* grand in the extreme.

Mr. James Blyth, of Edinburgh, has been elected to the chair of Natural Philosophy at Anderson's College, Glasgow.

H. Radziszewski, in Liebig's *Annalen,* publishes his experiments on the carbon compounds which exhibit phosphorescence. According to him, the phenomenon occurs with those compounds which combine in the presence of alkalis with ozone or active oxygen, or possibly in some cases with peroxides.—*Athenæum.*

Indian Portland cement is amongst the most recent of Indian manufactures. By a simple and almost purely mechanical process, a cement capable of bearing a pressure of 650 to 1,000 pounds and upwards is produced from ordinary *kankar* combined with a certain proportion of purer limestone of local origin. A company has been formed, and works have been erected for the production of the cement of Sealdah.—*Athenæum.*

Liquefied Ozone.—MM. Hautefeuille and Chappuis announced at a recent meeting of the Académie des Sciences they had produced liquefied ozone. They secured this end by great reduction of temperature, and the passage through the gas of the silent electrical discharge. The gas first assumed an azure blue colour; under a pressure of several atmospheres, it appeared of a dark indigo blue. At ninety-five atmospheres, when suddenly removed, the tube was at once filled with a mist, indicating liquefaction. Ozone was shown to be explosive: if a mixture of oxygen rich in ozone be rapidly compressed at ordinary temperatures an explosion takes place.

The United Arts Club is the name of a new institution in formation at Lancaster House, Savoy, W.C. The names of the honorary committee comprises:—Sir Julius Benedict, H. J. Byron, Luke Fildes, A.R.A., W. P. Frith, R.A., E. W. Godwin, F.S.A., Henry Irving, Blanchard Jerrold, J. E. Millais, R.A., E. Solomon, Edmund Yates, and other well-known names. The United Arts is to be entirely a social club, formed for the purpose of facilitating intercourse between members of the literary, dramatic, artistic, and musical professions; and candidates must be prepared to show that they possess the necessary qualifications. The annual subscription is three guineas; and the entrance fee is three guineas. The subscription payable on election rendering the member free of further payment until January, 1882. Mr. G. Earn Murray is the secretary and manager.

Burns's Poems in his handwriting has been presented to the Trustees of the Burns Monument at Ayr. It is a small quarto of fifty pages, and was given by the poet to Mrs. General Stewart, of Afton, in 1787.

The Newnham College, Cambridge, Lectures this term include courses by four lady lecturers, Miss Crofts, Miss Merrifield, Miss Harland, and Miss Scott. M. Boquel intends to make *viva voce* translation into French from Lord Lytton's "Caxton's" a prominent feature of his course. The lectures are now delivered in the North Hall of Newnham College.

Mr. Joseph Anderson has recommenced at Edinburgh his *Rhind lectures on archæology.* He is still dealing with "Scotland in Early Christian Times," and the first lecture of the new series was devoted to "Decorative Metalwork." His other topics are "Decorative Stonework," "The Art of the Monuments," "The Symbolism of the Monuments," and "Inscribed Monuments."

M. Cros drew the attention of the Académie des Sciences, on October 11th, to a memoir presented by him in 1872, in which, guided by theoretical considerations, he drew conclusions on the mechanical action of light, which he thinks have a great similarity to those of Prof. Bell. For example, a ray of light sent into a tube resonating with a certain note was interrupted a corresponding number of times in a second, and thus by the alternate condensation and rarefaction of the air sounds were produced.

THE SCIENTIFIC REVIEW
AND
Scientific and Literary Review

NOVEMBER, 1880.

REMEDIES FOR INDUSTRIAL DECLINE.

No one, we think, will gainsay the statement that if we can cheapen and improve to the utmost our industrial productions, we must be doing all that can be done to remedy any depression of trade that may exist.

But the utterance of an apothegm, however true, is merely speaking out "prave worts," as Shakespeare's Sir Hugh Evans calls them. We must, to be useful, go beyond this, and point out the course of action that is to be adopted in order to give practical importance thereto.

To us this is a matter of the greatest simplicity for we cannot give any better advice than what we have already put forward in the pages of the *Scientific Review*, namely, the promotion of technical education, or rather, instruction in practical science in regard to its applications to our arts and manufactures, and above and beyond this the enactment of good and cheap Patent Laws.

Probably these assertions will be met by the cry that is your old story; and we should have been disinclined to have again reiterated what we have so often stated, had we not been able to place before our readers the opinions of a new advocate for the amendment of our Patent Laws.

We refer to Mr. STANDFIELD, a scientific engineer, who has recently published his views on the subject and submitted them to discussion at a recent meeting of the Institution of Mechanical Engineers. He affirms that the cheap Patent Law of the United States has been and still is the secret of the great success of that country. . . . The invention we suppress takes root freely in the United States, which, consequently supplies our marts with large quantities of labour-saving devices, whereas if our laws were fair and equal we should supply their marts, and use the proceeds for purchasing their grain without impoverishing our country by a great loss of capital as at present. In the course of the discussion it was remarked that it was evident that there was something wrong when America could pay £9 where England paid £6 per ton for iron, and 9s. instead of 6s. per day for labour, and yet beat the English in the open market. He thought it was the duty of the Board of Trade, when the country was losing its trade, to inquire as to the cause of it. There was only one reason for it, and that was the abundance of labour-saving tools used by the Americans, because their mechanics could get all their appliances protected so cheaply.

Mr. Standfield pointed out that by suppressing native genius through heavy patent fees, England had driven away many national industries in which she had once held a foremost place. The pianoforte trade was one, London being rapidly stocked with instruments made in NewYork. The watch and silk trades had been driven out of Coventry and Clerkenwell, while machine-made watches were being developed in America, where labour was 50 per cent. dearer. American cheap patents and labour-saving tools alone account for Coventry's and Clerkenwell's misery and decay, and for England's serious loss of revenue and national income. If our workmen were allowed to become inventors they would prove quite as well able to design and manufacture machinery for the construction of cheap watches as the Americans. On the present system our best mechanics, if they have any ambition, are compelled to emigrate to America, where alone they can find an opportunity of utilizing their genius."

Further on the speaker said: The American patent law have given the inventors of such small but useful articles as sewing machines such a good opportunity of universally introducing their inventions that it is now not worth the while of any manufacturer here or elsewhere to attempt to compete with the American houses. There are 4,000 skilled artisans employed in the United States in this small manufacture alone. While American organs of numerous descriptions are not only excellent but cheap, there is not a single cheap English organ known to the public.

What has occurred to our piano and watch trade is now occurring—if it has not already occurred—in regard to the manufacture of locomotives and many other manufactures, to the partial ruin of our trade, wealth, and empire.

In the course of the discussion, the apathy of inventors and industrial pioneers as regards patent reform was alluded to. We certainly must admit that this is unfortunately too true. We would desire to arouse them. Let them be up and doing. The Inventors' Institute is to re-commence its labours in the present month. Let them rally round it with the dogged determination to secure a really cheap and good Patent Law. Messrs. Anderson, Hinde Palmer, Broadhurst, Mundella, and Brown, M.P.'s, have a Bill prepared ready to be launched in the next session of Parliament, and the Working Mens' Congress have declared in favour of Patent Law Reform. So let the watchword be Onwards! Onwards!! Onwards!!!

Proceedings of Societies.

ARISTOTELIAN SOCIETY.

Oct. 11th.—Mr. H. S. Hodgson, President, in the chair.—The President delivered an opening address. After a few introductory remarks relative to the past and future work of the Society, the meaning of the term "philosophy" was defined as being the most complete *rationale* of the universe possible to man, The axioms and laws of any subject constitute its science ; the explanation of the facts which lies at the root of the laws governing it, which connect that subject with higher or larger subjects, is its philosophy, The question as to whether philosophicial truth is finite or infinite was then touched upon. In studying the history of the progress made towards a satisfactory *rationale* of the universe, *i.e.*, the history of philosophy, it is important to note that there is a main highway which leads to the final aim, and that there are side ways. It is for the student to decide whether the work or theory before him is in the high way of philophy, or is a subsidiary inquiry or a false start. The successive advances and retrogressions made in ancient philosophy, beginning with the Ionic school and ending th Neo-Platonism—the portion of the istory of philosophy studied by the Society in its previous session—were then noticed, the grand result being the elaboration of a great philosophical system by Aristotle. The work of this great philosoper was then treated of, and its past and present influence upon the religions of mankind, more especially on Christianity, was indicated. The struggle between Gnosticism on the one hand and Christianity on the other, resulting in the victory of the latter, was depicted, the fusion of this latter theological philosophy with the Aristotelian system producing the great philosophical system known as Scholasticism, which still remains with us; the principal question about Scholasticism to be decided by the student being not whether it could claim to be a philosophy, but whether the *rationale* offered by it was a true and sufficient one. The influence of the Renaissance, the Reformation, and scientific progress upon philosophy, was then mentioned ; in the last case the scientific conception of relations taking the place of the scholastic conception of causes. The general difference between ancient and modern philosophy was shown to consist in the increased predominance of subjectivity in the latter, which asks what we know about things and what they appear to us as being, the former inquiring simply into what they are. This change of attitude turned men's attention to the analysis of the mind, its functions and modes of operations, giving rise to modern pyschology. The importance of physiological psychology as an indispensable auxiliary of philosophy was insisted upon. The important work accomplished in philosophy by Kant was pointed out as a subject for much deliberation and discussion during the ensuing session. The philosophic systems of modern times then received passing notice. The study of philosophy was shown to be chiefly important for the light which it throws upon the state of philosophy itself at the present time, though it may also be advantageously studied from another point of view, that is, not so much in relation to its subject matter, philosophy, as by treating it as a portion of the general history of mankind. A third method is pursued by those who possess what they consider to be the true, final, snd sufficient *rationale* of the universe, viewing the history of philosopy in relation to their own theory, as in the case of Scholastics, Hegelians, and to some extent with the Comtists, the last reading by means of the law of three stages, not being so strictly dogmatic as either of the first two. The address concluded by dealing with the position of the Society with regard to these three methods of studying the history of philosophy by its adoption of the first plan of study.

FLETCHER'S GAS HEATING BURNER.

Mr. Thomas Fletcher, of Museum-street, Warrington, who is well known as an eminent practitioner of the art of producing gas and petroleum furnaces suitable for use in laboratories and manufactories of various kinds, has recently given much attention to the production of gas heaters suitable for domestic and general requirements ; the result being the production of a heating burner which, after much experiment and very conclusive trials, has been found to possess the highest degree of efficiency. Having ourselves well used this burner we can testify that it is, without exception, a most valuable instrument for the production of heat for a variety of purposes. It has from three to four times the power of any burner similar in appearance ; it being an arrangement horizontally on the Bunsen principle with the flame issuing from a gauze dome. The flame is *solid*, intensely hot, and perfectly free from smell. It gives a duty *higher than the calculated theoretical maximum* for the gas consumed. It cannot be damaged by the dirtiest work. In case the perforated copper dome gets choked with dirt, it can, when the burner is warm, be lifted off and washed or brushed clean. Any liquid spilt so as to get inside the burner flows out by the side tube without the possibility of damaging the burner. Allow me also to call your attention to the casting of the body of the burner, which is cast all in one piece without a joint, thus doing away with one great fault—causing liability to leakage—in most of the burners at present in use. Mr. Fletcher states, and we have no hesitation in expressing our concurrence in his statements, that he considers this burner one of the greatest advances yet made in the practice of heating by gas. Mr. Fletcher has a gas fire arrangement to fit this burner, in preparation.

As regards the applicability of this burner to cooking by gas, patented and manufactured only by Thomas Fletcher, 4, and 6, Museum-street, Warrington, the following remarks by Mr. Fletcher may be interesting :—

We have, he says, used gas to the total exclusion of fires for cooking for the last 18 years. During that period constant experiments have been made, and the system repeatedly remodelled, with the object of getting the most perfect results with the least trouble and expense, for our own convenience. The matter is, therefore, so far as practical necessities are concerned, by no means new, although I have never up to the present time attempted to create a business for cooking apparatus.

The burners and oven, specially designed, are patented in all details, and are the same precisely as we have now in daily use. They are both simple, cheap, and within the capacity of an ordinary servant. The actual cost of gas cooking is about the same as that of coal, but the absence of gas for cooking in our own house would entail, in labour and dirt, at least an extra servant and a greatly-increased wear and tear in cleaning. For 18 years our cooking has been done on a table under the kitchen window. The oven and three boiling burners are all the apparatus necessary for 6 to 14 people. The smaller oven and two boiling burners are sufficient for small families.

Many who have this arrangement in use will soon forget the taste of cold food and warmed-up messes, as the cooking for the day is done with so little trouble that the exact requirements for the day will only be prepared for.

The oven is fully hot in less than one minute. To work the whole of the burners and the largest oven at their fullest power all at once requires a ⅝ inch gas supply pipe and tap, which can in almost every case be fixed by a plumber for a few shillings. In case of removal, the pipe can be taken and refixed in a new house with little expense. Our own fittings have travelled through four houses in 18 years.

The oven is the most important point; underneath the burner small joints of meat, fish, potatoes, apples, &c., can be roasted perfectly, and toast quickly made. In the lower oven, pastry can be baked quickly and perfectly, and meat can be roasted, not baked as in an ordinary oven. In the upper oven, meat can be stewed, custards, rice puddings, &c., made, and the hundred odd things done which are so constantly required. This upper oven is not fitted to the small size apparatus, and is not necessary in the ordinary cooking for small families.

With regard to the system by which the oven is heated, the burner is at the top of the lowest part, where the gas is perfectly burnt, thereby heating the bottom. The burnt air is taken in at the sides and carried up round the food as a hot jacket ; the same thing is done again in the upper oven.

By this system fish can be cooked underneath joint or fowls, and pastry, all at once with one burner, without the slightest alteration in the most delicate flavours. All are as perfect as they can be, and by this system the consumption of gas is reduced to less than one-half what is usually burnt, whilst any character of heat, dry or moist, quick or slow, can be got instantly without trouble.

The boiling burners are Fletcher's patent cooking burner, mounted on a tray in such a manner that the whole can be taken apart in a minute, and cleaned or washed. The joints are made with short lengths of india-rubber tubing for the convenience of servants, but they can be supplied with screw couplings to order, without extra charge.

The burners give the highest duty ever obtained for the gas consumption, and all parts are simple standard patterns, and interchangeable.

The boiling burners are two sizes: the largest, whilst at its fullest power, will burn 25 cubic feet of gas per hour, is for large pans and quick heating. It will boil quickly four or five gallons of water for children's baths, and will, when required, keep a small pan boiling steadily by simply turning the gas low. The small burners at their fullest power burn 10 cubic feet of gas per hour, and are for general work. It is advisable to use the large burner only, as far as possible, for very large or very small work, as it is not so ecoconical as the small burners for medium work, although the difference is not great. As soon as boiling heat is reached, turn the burners low ; about 2 feet of gas per hour will keep a pan boiling.

Pans and Kettles. — The stamped wrought iron pans of Hopkins and Co., and copper or tin kettles, are strongly recommended as the best for gas cooking. It does not pay to use cast iron pans and kettles.

Smoothing irons can be quickly heated on one of the small burners.

Instructions for Oven.—Hold a light near the tube running crossways under the oven, and turn on the gas. If, by accident, the gas ignites at the jet in the open end of the tube, turn it out, and light again until a line of greenish blue flame is seen under the oven. A good gas supply is quicker and cheaper to use than a poor one, and is also necessary to do first-rate pastry. At its greatest power it requires about 16 feet of gas per hour, but for roasting meat only half this is necessary.

Mr. Paul Crippen, of Bronson, Mich., has patented a *waterproof paint compound*, consisting of alum, coal tar, and sulphur boiled together.

A NEW ROCK DRILL.

THE skill of a great many able mechanics and engineers, and a great deal of capital, have been employed in simplifying and perfecting machinery for drilling purposes, the principal object being to avoid breakages, which are far too common in the ordinary machines. It has been found by actual observation that where any great amount of work is being done it requires six drills to accomplish what should be done by four on account of the loss of time occupied in repairing broken parts.

In former machines the parts most liable to breakage were the valves, and as no modification of their construction has been sufficient to give them a durability which compares with that of other parts of the engine, the difficulty in many cases seems irremediable, and the only recourse is to have a sufficient supply of duplicate parts on hand to be ready for emergencies.

Notwithstanding the many failures, mechanics and engineers, appreciating the immense benefits to be derived in cases of success, have pluckily continued with their experiments. As valves could not be made sufficiently durable, the line of experiment naturally tended in the direction of valveless engines. These were known to be perfectly practicable in some respects, while in others, more particularly in the displacement of the compressed air or steam at the ends of the cylinder at the termination of the stroke, and giving a cushion for the piston to prevent severe concussion with the cylinder heads, the problem has remained unsolved till now.

Mr. S. G. Bryer, of Saugus, Mass., who has had an experience connected with rock of over ten years, after much experiment has devised the only thoroughly practical valveless engine for a rock drill yet made. The piston of this drill is its own valve, thereby dispensing with the small valves and their consequent wear and breakage, together with many other small and weak parts common to other drills. As will be seen by reference to the engraving, it has fewer parts than any other rock drill in the market. Practically there is nothing but the cylinder, the piston, and the rotatory motion, which is perfectly simple and scarcely exposed to wear or breakage. The blow delivered is as positive and effectual as that from any other style of drill—a result which has never before been obtained with a valveless engine.

The advantages of this drill consists in such an arrangements of parts as to entirely obviate the use of tappets, valves, or other other auxiliaries depending for their action upon percussion, while it is a perfectly effective and smoothly-working machine, free from liability to accident. It is sought to reduce it to the smallest number of unexposed parts, and so to simplify them that they can be easily repaired or duplicated and be interchangeable.

In the upper portion of the sectional cut, midway between the centre and either end of the cylinder, are two annular grooves; these are connected on the back by a passage way, forming a steam chest, to which the supply pipe is attached. The exhaust port is located in the centre of the cylinder. In the piston head are two grooves, which also pass entirely around, corresponding in width to those in the cylinder, distant from each other half the space of the latter from the exhaust port, in the right-hand portion of the piston, extending from the grooves in the same to either end, is shown a passage way for steam. In the lower part of the cut is what is termed the cushion valve, its lower end resting upon the lower head of the valve chamber. The valve is cylindrical, and reduced in size, between the ends and middle, to admit of free passage of steam to the exhaust ports of its chamber.

From this description, the operation of the drill can be easily understood. The steam forms a cushion at the end of each stroke, which prevents the piston from knocking. To the upper head of the cylinder is secured the usual device for rotating the piston and drill, consisting of a rod with spiral flutes, entering a socket in the piston head.

The improvements embodied in this drill secure a larger percentage of useful effect, with the least supply of steam, the utmost expansive power of the same being utilized by its peculiar construction; and since no part strikes another to give it motion, the wear is insignificant. The inventor has displayed great skill in locating the control of the piston's action within itself, thus rendering the free and perfect operation of the drill wholly independent of auxiliary appliances. The drill may be operated equally well by the use of compressed air, and is absolutely non-freezing.—*Scientific American.*

SPAGNOLETTI'S FIRE ALARMS.

THIS invention, recently patented by its inventor, C. E. Spagnoletti, the eminent telegraph engineer, consists in a system of electrical fire alarms. In order that the chief department or local district depots may be early advised of the locality in which a fire may break out, the inventor employs a train of clock work to run off paper ribbon similar to a Morse telegraph instrument. This train of clock work is automatically started into action by the same current that sends the signal from the place the alarm is given. It can also be made to stop automatically, or it can be stopped by the attendant after seeing what station has given an alarm. The instrument has an indicator on it, and shews when it requires winding up; in addition to this a key for sending a current to any outlying station is attached for acknowledging the signal or signals. A bell is also attached, which is made to ring when winding up is required, so that if neglected to be seen it can be heard. Another bell, or bells, is also attached to call attention when an alarm is given. These bells may be of the trembling bell system; but I attach to them an earth connection for the bell hammer to work on, so as to discharge the line wire, and thus have any number of bells on one wire, which without this arrangement cannot be done.

The signal given, denoting a station sending an alarm, is given by a code of letters or ciphers. These signals are sent in various ways: first, by turning a wheel on which certain metal projections are placed, to rub in contact with a spring, and thus make letters or ciphers required, indicating the station from which sent. This wheel may be turned by hand or clockwork. If a return signal is required, or an acknowledgment, this is done by a second wheel with a metal projection resting on a spring, or *vice versa,* after the completion of a revolution giving the station's signal letter or cipher. Secondly, a stroking board for sending signals is used. This is a piece of wood, or other insulating material, with pieces of brass or other metal let into it or placed on it in such positions as to make the required letters or ciphers. This is connected to the line wire or earth, and a metal brush is connected to one or the other (earth or line), only to the reverse of the one the board is connected to, and by stroking the brush over the pieces of metal the letter or cipher is sent to the instrument at the station requiring to be signalled to. If a reply is required, the brush is put into a socket to which a bell is connected to earth and a current sent by the key or button from the station, acknowledging the signal. Thirdly, by preference, a box is used with graduating slopes or planes, covered, or partly covered, with metal or wire, so arranged that a metal ball, ring, or wheel will gradually roll down these slightly inclined planes or slopes, and in order to arrest its speed even stages are provided here and there. As the ball, ring, or wheel follows its course and runs over the metal lines it joins one to the other through itself, and thus completes the circuit. The metal being at required intervals insulated (or terminated in certain sections), the ball ceases to make contact when passing over these portions, and thus any signals required can be sent. The ball following its course can be made to repeat any number of signals, or a signal any number of times; or the ball can be made to press down light springs as it travels, the springs making contact as required. On the ball terminating its course it rests on pieces of metal, and connects (if required) a bell for the acknowledgment signal from the station the signal has been sent to, so that the simple act of dropping this small metal ball into the box starts the instrument at the station, records the letter or the cipher of the station sending the signal any number of times required, rings a bell to call attention at the far end signalled to, and finally connects up a bell for the return or acknowledgment signal.

One line wire is all that is required, but with two a system can be arranged by which all outlying stations can be signalled to, giving notice where a fire is, so that if any station signalling to the head office of the district that a fire has broken out, the head office can send to all outlying stations, and advise them where that fire is and where they are to go to. This is done by an audible or other signal.

One instrument is sufficient for any number of out-lying stations, but by having less stations on one, and using two or more, it may be found more convenient. One battery is required for the instrument, and one may be used for the bells. When the system of sending between all stations is adopted, this can be arranged by multiplying the apparatus.

THE AMERICAN SCIENCE ASSOCIATION.

OUR esteemed contemporary, the *Scientific American*, thus reports the proceedings of this association :—

The early promise of a large and, in the fullest sense of the word, popular meeting was amply fulfilled. Nearly a thousand members were registered; 595 new members and 45 fellows were elected, among them Mrs. E. A. Smith, of Jersey City, the first lady thus honoured. The number of papers entered was 280. A very active interest was manifested in the proceedings throughout, and the hospitality of the people of Boston and the surrounding towns was unbounded. Boston and its vicinity are rich in institutions, manufactories, pleasure resorts, and points of historic interest, and not a few of the members found these sources of pleasure and profit unsurpassed even by the regular proceedings of the association.

Comparatively few papers were read before the general sessions, the attendance being so large and the number of papers so great that most of the work was done in the sections and sub-sections. In view of the increasing size of the annual gatherings the committee on membership reported in favour of extending the scope of the association, recommending that instead of two sections with sub-sections, as at present, the association should have eight as follows :—

A—Physics. B—Astronomy and Pure Mathematics. C—Chemistry, including its applications to agriculture and the arts. D—Mechanical Science. E—Geology and Geography. F—Biology. G—Anthropology. H—Economic Science and Statistics. It was also recommended that there may be a permanent sub-section of microscopy, which shall elect its own officers, and be responsible directly to the Standing Committee, and that the Sectional Committee of any section may, at its pleasure, form one or more temporary sub-sections, and may designate the officer thereof. The report will be acted upon at the next meeting.

Among the other reports of special committees two were of general interest. The report of the Committee on Science-teaching in the Public Schools has already been noticed. The committee to memorialise Congress and State legislatures regarding the cultivation of timber and the preservation of forests recommended a law to protect trees planted along highways, and to encourage such planting by deductions from highway taxes; also the passage of a law that shall exempt from taxation the increased value of land arising from the planting of trees where none were growing to such period as may appear proper, or until some profit may be realised from plantations; by appropriations of money to agricultural and horticultural societies, to be applied as premiums for tree-planting, and for prizes for the best essays and reports upon subjects of practical forest culture; by encouraging educational institutions to introduce courses of instruction having reference to practical sylviculture; by laws tending to prevent forest fires; by imposing penalties against wilful or careless setting of such fires, and enlarging and defining the powers of local officers in calling for assistance and in adopting measures for suppressing them; by establishing under favourable circumstances model plantations; by the appointment of a Commission of Forestry under State authority analogous to the Commission of Fisheries.

The cable message to the British Association received a cordial answer returning thanks therefor. A message of congratulation was also sent to the venerable M. de Chevreul, senior member of the French Academy, on his 95th birthday.

The officers elected for the next meeting, in Cincinnati, to begin August 17, 1881, are—President, Professor G. J. Brush, of New Haven; Secretary, Professor C. V. Riley, of Washington; Treasurer, Professor W. S. Vaux, of Philadelphia; President of Section A, Professor A. M. Mayer, of Hoboken; Secretary, Professor John Trowbridge, of Cambridge; Vice-President of Section B, Dr. George Englemann, of St. Louis; Secretary, Professor William Saunders, of Canada; Auditing Committee, Professor Henry Wheatland, of Salem, and Professor Thomas Meehan, of Philadelphia.

In the permanent sub-section of Chemistry, Professor William Ripley Nichols, of Boston, was elected Vice-President, and Professor H. W. Wiley, of Lafayette, Ind., Secretary. In the permanent sub-section of Anthropology, Colonel Derrick Mallory, of Washington, was elected Vice-President, and Judge J. G. Henderson, of Winchester, Ill., Secretary. A resolution providing for a social reunion of the sections on the second evening of future meetings was adopted.

As already remarked, the most of the papers were read in the several sections and sub-sections. It would not be possible within the scope of this article even to mention them all by title. A few of those of most general interest may be noticed. In Section A (Physics) Professor A. M. Mayer described the construction and use of the topophone. Professor A. Graham Bell presented his new invention, the photophone. Mr. A. P. Dudley, of New York, read a practical paper on "Transportation Expenses and their Reduction," and gave the results obtained by his invention, the dynograph, designed to test questions in regard to the economical handling of railway trains. This instrument shows that on ordinary roads it is more economical in fuel to run freight trains from eighteen to twenty miles per hour than at ten or twelve. It shows the largest types of engines to be most economical, haulng greater loads per pound of coal, reducing the ratio of train expenses per ton carried. Also, that the dead weight per car, per ton capacity of freight, should be reduced to the lowest limit consistent with safety, as it costs proportionately more to haul empty cars than loaded ones.

Mr. Wm. H. Ballou, of Chicago, read a paper on the "Mississippi River Improvement System." A hint of the magnitude of the problems involved was given in the shifting of the course of the Mississippi at Cairo, Ill., a mile in one year. Still more remarkable than this are the operations of the Missouri River. At one time Council Bluffs enjoyed its presence in immediate proximity to the city and the benefits of its commerce, in consequence of which the city became the terminus for the Western railways in preference to Omaha, three times its size. These railroads erected depots and stationed the offices of the general Western superintendents here. The Union Pacific road constructed an immense bridge here, and in common with other railways built a union depot at Council Bluffs. No sooner had this work been completed than the Missouri performed the unexpected feat of moving its channel over to Omaha, three miles away.

Mr. E. B. Elliott, of Washington, read a paper on "Electric Lighting as applied to Large Areas;" Mr. C. J. H. Woodbury one on "Friction and Lubricating Oils;" Professor B. F. Hedrick, of Washington, on "Patent Laws as a Means for the Advancement of Science." Of scientific papers less obviously bearing upon practical affairs the number was large—too large for their reviewing here.

In the sub-section of Chemistry a valuable paper on "Laws Governing the Decomposition of Equivalent Solutions of Iodides under the Influence of Actinism" was submitted by Professor A. L. Leeds, of the Stevens Institute. Professor A. A. Breneman, of Cornell University, exhibited samples of common stoneware, hitherto decorated only in blue, on which he has been able to obtain a wide range of colours. On one specimen vase a vine in green was painted upon the ordinary grey body of stoneware. This cheap ware may in this way be made the basis of a new process of underglaze decoration in which the entire piece—colour, glaze, and body is completed at a single burning. The theory of the new process rests upon the thickness and comparative impressibility of the glaze. A note on "Water Analysis" was read by the same gentleman.

Mr. H. W. Wiley, of Lafayette, Ind., read a practical paper on the "Manufacture of Glucose." Professor S. B. Sharples showed a method of testing sugar and molasses; Mr. E. T. Cox discussed the "Oxide of Antimony found in Extensive Lodes in Sonora, Mexico;" J. C. Kleinschmidt read a paper on Foreign Substances in Iron;" and Professor T. Sterry Hunt one on the "Genesis of Certain Iron Ores."

Section B (Natural History) gave evidence of great activity in this field of science. The subject of "Biological Development in the Animal Kingdom, as Manifested in the Paleontological and Embryological Study of Sea Urchins," was illustrated at great length by Professor Alexander Agassiz; and Professor A. Hyatt found a practical illustration of the "Theory of Evolution in the Transformation of the Planorbis." Incomplete adaptation, as illustrated by the "History of Sex in Plants," was treated by Mr. L. F. Ward; and the "Evolution of Parasitic Plants," by Mr. Thomas Meehan. Dr. S. V. Clevinger submitted a less popular communication on the "Plan of the Cerebro-spinal Nervous System." The "Economic Aspects of Natural History" were touched upon by Professor T. J. Burrill, of the Illinois Industrial University, in a paper on the microscopic cause of "fire blight" in pear trees and "twig blight" in apple trees. Also by Professor Riley in a paper on the "Cotton Worm;" and by Mr. A. J. Cook, who described two new methods of fighting injurious insects. The papers in the sub-section of Microscopy were chiefly such as were of interest solely to the specialists of that department.

The papers in the sub-section of Anthropology were many and rich in curious information. "The Ethnology of Africa" was discussed by Professor A. S. Bickman. The Myths. Folklore, Language, and Games of the Iroquois Indians were learnedly discussed by the only lady fellow, Mrs. E. A. Smith. Colonel H. B. Carrington read an intesting paper on the "Dakota Tribes." Judge Henderson described the textile fabrics of the ancient inhabitants of the Mississippi Valley. In explaining the textile art among the mound-builders and other ancient American aborigines, he showed that the modern Indians and these ancient people are bound together by a similarity in instruments and processes of spinning and weaving. The material used was the bush of various trees, nettle, and the hair of the bear, buffalo, deer, and dog. In working up vegetable substances, the bark was first macerated, and, after being dried, it was spun in a multitude of ways. The rudest process was rolling on the thigh. The next improvement was a rude spindle, which passed through various processes of evolution to the modern spinning wheel. The gradations of elaboration through which the loom has passed were illustrated by a series of drawings, collections of raw materials, and models of spindles and looms.

Mr. William McAdams described the agricultural implements of stone anciently employed by the natives of the same region, and Mr. W. Putnam spoke of the conventional ornamentation of ancient American pottery. In a paper on ancient quarries of Oriental alabaster and flint in the West, Rev. H. C. Hovey described and illustrated by maps, diagrams, and specimens, some remarkable discoveries made by him in Wyandotte Cave, Indiana. Professor E. S. Morse gave an instructive account of his investigations among the shell heaps and caverns of Japan.

In the subsection of Geology Mr. N. H. Winchel read a paper on "Capriferous Series in Minnesota," and Alexis A. Julien gave a description of the excavation of the upper basin and clove of the Kaaterskill (Catskill) Mountains. L. W. Bailey reported the progress of the geological investigations in New Brunswick in 1879 and 1880, and was followed by H. C. Lewis, upon the "Tertiary Age of Iron Ores of the Lower Silurian Limestone Valleys." Professor Silliman spoke upon the turquoise localities of Las Cenillos. Other contributions to this subsection were:—"Granites in the White Mountain Notch upon Mount Willard and their Contact Phenomena," by George W. Hawes; "Eruptive Rocks of Mount Ascutney," by Professor C. H. Hitchcock; "Coals of Galisteo, New Mexico," by Professor B. Silliman; and "Auriferous Gravels of the Upper Rio Grande in New Mexico," by the same.

RECENT AMERICAN AND FOREIGN PATENTS.

An improved match box has been patented by Mr. George Wenström, of Stockholm, Sweden. It is provided with a sliding cap or inner box, which is divided into two compartments—one for holding matches and the other for receiving the end of the cigar for lighting—and formed with a slit at one side for the insertion of a match within the lighting chamber; also, in a tongue formed on the inner box, which, in connection with an opening in the outer box, forms a cutting device, combined with a chamber formed at the inside of the match box to receive the cuttings.

Grinding Mill.—An improvement in mechanism for mixing and feeding material to the stones of a grinding mill, whereby the action of the mixing and feeding devices is rendered uniform, one being started or arrested at the same time with the other and operated at the like rate of speed, has been patented by Mr. James Lowell, of Purcellville, Va.

An improvement in stove boards has been patented by Mr. A. Irving Griggs, of New York city. The invention consists in constructing a stove board made with a bead and a hem, and having the lower ply of the hem corrugated, and its edge turned up against the plate within the cavity of the bead, and the veneer cemented to the lower side of the middle part of the plate.

Messrs. Marshall J. Allen, of New York city, and William E. Bradley, of Frankfort, Ky., have patented an improved process of *saving the sugar and starch* contained in a waste product *in the manufacture of whiskey* and utilising it. The process consists in freeing the slop from the bran, chaff, and coarse particles of grain, and introducing the liquid thus obtained in place of water in the succeeding operations with fresh grain.

An improved ironing machine has been patented by Mr. John Socias y Rubio, of New York city. This invention is an improvement in the class of machines in which the sad iron is suspended and adjusted vertically by a screw, and is designed to provide means for suspending a sad iron which will allow it to be moved in any direction over the ironing table; also, to suspend the sad iron by yielding or elastic devices, to enable it to be operated easily and efficiently.

Mr. Benjamin F. Sherman, of Ballston Spa, N. Y., has patented an improved *hydrocarbon furnace*, having the bottom of its combustion chamber made with a series of longitudinal pockets containing asbestos or analogous absorbent material, with perforated oil pipes embedded therein, and with alternating air chambers rising between said pockets and communicating below with the portion of the furnace corresponding to the ash pit, the said air chambers being perforated at the top and surmounted by inclined hoods or sheds which deflect the currents of air down upon the surface of the saturated asbestos.

Mr. Louis Graf, of Van Buren, Ark., has patented a process for producing *coloured photographs* on linen or analogous material, which consists in the employment of a collodion mixture consisting, essentially, of distilled water, nitrate of silver, absolute alcohol, chloride of calcium, citric acid, and ordinary collodion.

An improvement in the class of *planters* having reciprocating seed slides, with which auxiliary devices are combined to assist in regulating the discharge of seed, has been painted by Mr. Leonhard Grieser, of Minonk, Ill. The invention consists, mainly, in the employment of a curved reciprocating block or bar, which is located in the hopper and attached to the seed slide, with which it reciprocates simultaneously, so as to alternately open and close one of the two adjacent openings, and thereby alternately permit and prevent the escape of seed through the openings.

Mr. W. I. Wooster, of Harvard, Ill., has patented an improved *blind fastener and slat operator*, which consists of a slotted strip of wood or metal fixed vertically on a side of the blind and connected with each blind slat, said strip of wood or metal being moved vertically to open or close the slats and to bolt the blind by means of a rod that passes through the window frame.

An improvement in umbrellas of that form in which some of the ribs are longer than the others, or in which the staff is connected eccentrically to the cover, to allow the person to occupy the centre of shelter and be better protected from rain or the sun's rays has been patented by Mr. Alexander H. Ege, of Mechanicsburg, Pa.

A compound rotary and reciprocating churn in which is employed a rotary dasher to whip the milk, in combination with a reciprocating dash to displace the liquid, so that the entire liquid contents of the churn may be quickly and continuously presented to the action of the rotary paddle or dash by the movement of the reciprocating dash, has been patented by Mr. Andrew Mearns, of Tolesborough, Ky.

Waggons.—Mr. Joseph C. Fowler, of Arcola, Texas, has patented an improvement in running gear for waggons. The improvement relates to king bolts and coupling devices for connecting the forward axle of waggons, carriages, and other vehicles, and it consists in a king pin or bolt which passes in the bolster through braces and enters a socket in the top bar of the axle, where it is held by a cross pin, the bolt and braces thereby sustaining the weight. The lower end of the bolt is formed as a rounded bearing in a direction transversely of the vehicle, so that the forward wheels and axle may conform to the ground without effect on the waggon body.

An improvement in pipe couplings has been patented by Messrs. David B. Hand and Ephraim H. Reitzel, of Columbia, Pa. This invention particularly relates to a means for connecting the heating pipes between the cars of a railway train, but is also applicable to other purposes. It consists in a novel construction and arrangement of coupling devices, whereby provision is made for affording a universal motion to the pipes.

Mr. John Collins, of Brooklyn, N. Y., has patented *apparatus for generating gas for minerai waters.* This is an improvement in that class of carbonic acid gas generators in which the discharge of acid into the chamber containing lime or other carbonate is regulated automatically by the variation in the pressure of gas, which acts upon a piston that, in turn, tilts a pivoted lever, and thereby opens a valve that controls the escape of acid from its tank or holder.

An improvement in *gates* has been patented by Mr. Robert M. Grier, of O'Fallon, Mo. The objects of this invention are, first, to prevent the trouble arising from sagging of gate posts; second, to provide for widening the gate entrance when an unusual width is required; and, third, to furnish a gate of durable construction and requiring but a small quantity of lumber for its manufacture.

An improved *measuring pump*, designed to draw out all the fluid from a barrel, and to correctly measure molasses, oil, or any other liquid, and to dispense with oil tanks, measures, funnels, and tapping devices, has been patented by Mr. Fradelshon Harris, of Rockport, Ill.

An improvement in the class of *pendulums* designed for use in connection with clock requiring compensating pendulum has been patented by John W. Hile, of Leavenworth, Kan. This improvement consists in the construction and arrangement of parts, whereby the bob or weight is adjusted up or down automatically to compensate for changes in the length or extension of the pendulum due to changes in temperature of the surrounding air or adjacent surfaces or objects.

Mr. Perry A. Peer, of Comstock, Mich., has patented *a hinge*, peculiarly adapted to a V-shaped harrow. When it is desired to uncouple the two sections of the harrow, one of the sections is allowed to lie flat on the ground, and the other is raised to about a vertical position, and it may then be readily detached.

Mr. John O. Grisham, of State Line, Miss., has patented *a corn cutting and grinding mill*, which is an improvement upon the form of corn crusher in which the ears of corn in the husk are fed through throats, sliced into sections by revolving knives, and these sections then rendered fine by passage between grinding surfaces. The invention consists in combining with the feeding throats and knives, a set of spring seated tables, which hold the ends of the ears of corn while being cut, and which allow the sections being cut off to press down to accommodate the thickness of the knife, thus preventing the knife from hanging in the ear, and rendering the cutting action easier.

Mr. Isaac S. Schuyler, of Brooklyn, N. Y., has patented *a machine for cutting screw threads.* The improvements relate to machines for cutting screw threads on pipes and couplings, internally and externally, and are designed to accomplish such work more rapidly and perfectly than has hitherto been done. Rotary cutters formed with serrated edges are employed. The arbors of the cutters are fitted in a revolving head that has an endwise motion proportioned to the pitch of the screw, so that while the cutters rapidly revolve with their arbors they also travel in a spiral path upon the surface being operated upon.

Mr. Charles G. Trafton, of Slatersville, R.I., has patented *a thread guide for spooling machines* that is self-adjusting to the yarn as the latter runs from the bobbin to the larger spool, so as to avoid friction. It consists in a guide plate provided at one end with a curved friction service and at the other with a slotted flange and a plate, in combination with a rod having projections at its top to limit the movements of the plate sidewise and a screw which serves as a pivot for the plate.

Mr. James H. H. Taylor, of Lawrence, Mass, has patented a mechanism for *stopping and starting street cars*, so constructed that the momentum of the car can be used for stopping the car, stored up, ond again used for starting the car,

Mr. George Steinson, of East Chester, N. Y., has patented an *improved leg for bedstead frames*, which furnishes to the bed an elastic support. The leg is formed of flat curved springs, and a spiral spring placed in a box, the whole being supported on castors.

Mr. Frederick A. Baker, of Brooklyn, N, Y., has patented a *fire escape ladder* for the use of firemen. It can be readily secured to the windows of buildings from story to story to form a fire escape.

Improvements in *electric burglar alarm for safes* have been patented by Mr. Edwin J. Leland, of Worcester. Mass. These improvements relate to burglar alarm telegraphs connected with safes, vaults, and similar places, and arranged to give a signal at a central office in case the circuit is broken or the wires tampered with. Such lines usually have combined with them a galvanometer, so that any change of resistance caused by an attempt to put a loop in the line, and thereby cut out a safe or vault without breaking circuit, or from any cause, shall be indicated by the galvanometer. The object of this invention is to provide means for testing the line at any time and determining whether the safe or vault is in circuit, so that it will not be necessary to make a personal inspection of the vault or safe every time the indicator shows a change of resistance or the signal is operated, as such effects are often produced by crossed wires and electrical disturbances in the atmosphere.

A bottlestopper has been patented by Mr. Thomas G. Austen, of Oswego, N. Y. This invention relates to that class of devices that are designed to close the mouth of a bottle and yet to permit the gradual ejection or sprinkling of its contents.

Mr. Joseph T. Maybury, of Mobile, Ala., has patented a process of *canning oysters*, which consists of placing them in cans and pouring over them a hot mixture composed of water, salicylic acid, and vinegar, in the proportions of about ten gallons, one and six-tenths gill, and one-half gallon respectively, and then closing the cans and placing them in boiling water for a short time.

A novel skylight bar, in which provision is made for collecting the condensed moisture which accumulates on the interior surface of the glass and conducting it to the roof, has been patented by Mr. Fred Ruemping, of Kansas city, Mo.

A well casing, which is simple and effective, has been patented by Messrs. Henry Shear and Henry M. Toomey, of Arcola, Ill. The invention consists in a well and cistern casing formed of a number of segmental sections of earthenware or burned clay, provided with tongues and groves at the ends and with strengthening ribs on the inner sides.

A trunk fästener, patented by George A. Sofield, of Jersey City, N. J., consists in the combination with a bolt tongue having a transverse groove of a socket provided with a lodgitudinal groove to receive the bolt, and with a transverse groove containing a spring latch fitting into it and catching into the transverse groove of the bolt tongue.

Mr. Carey Inskeep, of Ottumwa, Ia., has patented an *improved hairpin*, which is so so constructed that it cannot become detached accidentally, but may be inserted and removed without disturbing the contiguous hair further than requisite to allow space for the body of the pin.

Mr. Benjamin Le Coultre, of Geneva, Switzerland, has patented a *chronograph* having both second and minute hands indicating on one dial and mounted on the same arbor. The inventor fits upon the central arbor of the watch a loose sleeve that carries the minute hand and a driving wheel, and outside of this fits a second loose sleeve carrying the second hand and a driving wheel. Upon a lever fitted for movement by a ratchet wheel in the usual manner are fitted the wheels that operate the second hand from the centre pinion when moved into gear, and upon a pivoted arm that is connected with the lever is a pinion that connects a fixed pinion on the centre arbor with the driving wheel of the minute hand. The driving wheels of both the second and minute hands are fitted with heart cams that are acted upon by a T-arm to bring both hands back to the starting point. By this construction a simultaneous action is obtained on both hanes—first, to set them in motion; second to arrest them; and, third, to turn them to the starting point.

An improvement in whiffletrees has been patented by Mr. Ferdinand O. Fischer, of Aptos, Cal. The invention consists in combining a lever spring, shouldered bar, and slide bar having end disk, with the end of a whiffletree.

Messrs. Carl P. Cullmann, of Idar, and Carl A. Lorenz, of Oberstein, Germany, have patented a process of *manufacturing onyx stones from agate*, by immersing one side in a bath of dilute nitric acid and iron, the other side in a bath of carbonate of potassa and water, and then drying the stones on a stove, and burning them to fix the colour.

Mr. Carl J. Renz, of Hudson. N. Y., has patented an *improved process of preserving fruits*, and more particularly grapes, pears, strawberries, and other fresh whole fruits without the use of a mother liquor. It is an improvement in that general process of preserving in which the air is first exhausted from the receptacle in which the fruit is placed, and in which the gases subsequently evolved by the fruit are taken up by an absorbent. The improvement consists in deodorizing and absorbing the condensable gases by a block of quassia wood or other material impregnated by quassia.

Mr. Israel V. Ketcham, of Brooklyn, N.Y., has patented an improvement in *milk pails* used by dealers for delivering milk in small quantities to consumers. The object of the invention is to furnish a self-measuring pail from which a regulated quantity of fluid shall run at each inversion of the pail.

A combined *door plate and letter receiver*, patented by Mr. Henry Free, of Lewiston, Me., is so constructed as to keep rain, snow, wind, and cold from entering the opening in the door, and it will allow the name or number to be readily changed.

An improved *book holder*, which is simple, effective, and convenient, has been patented by Wilhelm F. Eppler, of Herrstein, Germany. It is formed of a box, for lunch and other articles, and of two boards, between which the books are placed. All the parts are held together by cords attached to a slate placed below the lunch box or to the box itself, and are wound upon the revolving handle of the book holder.

Mr. Benedict Beebler, of St. Louis, Mo., has patented a *lumber polishing machine*, which is more particularly intended for polishing thin lumber, such as is used for making cigar boxes, and for similar purposes. It consists in a novel arrangement of a stationary bed-plate and a tightlyjournaled cylinder, whereby provision is made for simultaneously polishing both sides of the work as it passes through the machine.

THE BENEFITS OF VIVISECTION.

The "Popular Science Monthly" gives a neat summary of Dr. Charles Richet's arguments in defence of vivisection. He demands that it shall be judged by its practical results, and claims that if it can be shown that we have gained by this method of experiment the means of curing one or two diseases of man it must be considered legitimate. He cites a number of discoveries made through vivisection. Among them is the discovery of the circulation of the blood. "Galen established the fact that the arteries contained blood by observations in the artery of a living animal; Harvey opened the chests of living animals, cut into the pericardium, observed the contraction of the heart, and what was going on in the veins and arteries, and deduced from what he saw his theory of the circulation. Transfusion of blood, an operation resorted to in extreme cases with the best results in saving life, was introduced after its possibility had been ascertained from experiments upon animals first made in 1664 by Lower and afterwards by Denis. 'Experiment alone,' Dr. Richet says, 'will teach us precisely what quantity of blood is necessary and what is harmful; and if over sensitiveness forbids animal suffering for this end, then the experiments would have to be made on human beings.' The mode of death from the inhalation of carbonic oxide, and correlatively the method of avoiding or preventing death from inhalation, havebeen made known only through vivisection. So also 'all that we know in hygiene of the quantity of air necessary to support life is the result of experiments on dogs and rabbits. Sometimes a precise knowledge of the conditions of respiration has served to prevent men from perishing.' Only two methods exist by which we may learn the conditions of gastric digestion and collect its secretions, viz., by observation of gastric fistulæ produced by chance in man, and by artificial fistulæ in animals. The first method has been possible only in three or four instances, but the effect of food on the gastric secretion in dogs and cats has been largely observed; and the knowledge of the remedies which have been applied to the relief of dyspepsia has been derived from such studies. Our knowledge of nutrition has been largely added to by means of experiments in which dogs and cats have been submitted to varied alimentation, and from which the quantity and quality of food necessary to sustain life have been deduced. What we know of the nerves has been gained from studies of animals, as have also the means of relieving neuralgias and paralysis, in which, thanks to the scientific analyses of the vivisectors Fritsche, Hitzig, and Ferrier, 'we can pass from the effect to the cause, and assign to paralysis a central lesion at a well-determined spot, so that trephining at the spot may cause the paralysis to disappear. The experiments of Galvani and his followers on frogs have taught us to estimate the effect of the electric current on nerve and muscle, and shown us how to apply galvanisation to the prevention of the paralysis which ensues from the destruction of the motor nerves. The numerous patients relieved of nervous diseases 'by this admirable therapeutic agent have no call to speak ill of such vivisectors as Galvani, Aldini, Volta, Magendie. Marshall Hall, Remak, Du Bois Reymond, and many others, since it is to their discoveries that the relief of their ills is owing. Would Galvani have made his discoveries had he refrained from dissecting frogs? Would the elecric current have been applied to atrophied limbs if it had not been found that the action of this current in dogs was salutary and not dangerous?' Certain diseases of the urinary organs have been studied in animals. The treatment of sympathetic ophthalmia by section of the ciliary nerves of the deceased side has been shown to be advantageous by experiment, and the results yielded by experiments on dogs and rabbits have been applied to patients. The correct treatment of cataract kas been similarly learned. Encouraging progress is made by vivisection in the study of the formation of callus, of pseudarthrosis, of osseous grafts, of regeneration of bone by periosteum,—subjects of great importance in surgery. The vaso-motor theory, which plays a large part in the medicine and surgery of the present day, has been established by experiments on the great sympathetic and the rabbit's ear. Dr. Brown-Sequard has furnished useful ideas relating to epilepsy and tetanus from the results of painful experiments on dogs and guinea-pigs. Trial on animals is useful to determine the action of new medicines, for 'we do not wish to experiment on man at the risk of poisoning him, where animals can be employed,'—so with poisons. Finally, if we deprive *savants* of the right to submit living animals to experiment, we shall go back beyond the days of Galen. 'If all those who have been relieved—verily made to live again,'—says Dr. Richet, 'by modern medicine and surgery could speak, they would confound those who load vivisection with calumny, and they would hold that their own life and sufferings weighed more in the balance than the sufferings of those animals which have been sacrificed in laboratories to the lasting benefit of man.'"—*Journal of Science.*

Mr. John H. Hodges, of Attleborough, Mass., has patented a separable button, which csnsists in a curved wire catch combined with a cup having a short bevelled end lip and a protruding end. with opposite springs arranged between the side of cup and the curved parts of catches.

An improved blacking brush holder has been patented by Mr. Henry B. Perham, 665, West Lake-street, Chicogo, Ill. The invention consists in securing blacking brushes for transportation or packing in trunks with wearing apparel by an incasing crossbelt, which not only retains them in a compact form, but incases them so as to prevent the surrounding articles from being soiled.

An improved sulky plough has been patensed by Mr. Horace E. Reeves, of Fort Dodge, Ia. The object of this invention is to construct sulky ploughs in such a manner that the ploughs can be readily adjusted and controlled, will be firmly held while at work, and will yield should they strike an obstruction.